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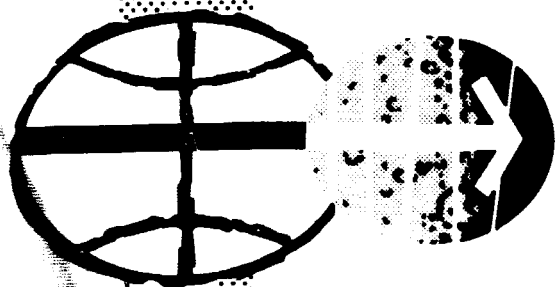
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MOBILE QUARANTINE FACILITY ALTITUDE TEST IN  
SPACE ENVIRONMENT SIMULATION LABORATORY



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MANNED SPACECRAFT CENTER  
HOUSTON, TEXAS

April 7, 1969


NASA PROGRAM APOLLO WORKING PAPER NO. 1346

MOBILE QUARANTINE FACILITY ALTITUDE TEST IN  
SPACE ENVIRONMENT SIMULATION LABORATORY

PREPARED BY

SPACE ENVIRONMENT TEST DIVISION

AUTHORIZED FOR DISTRIBUTION

  
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MANNED SPACECRAFT CENTER  
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## 1.0 INTRODUCTION

This report includes the test activities and results of the altitude test of the Mobile Quarantine Facility (MQF) conducted in the Space Environment Test Division (SETD) chamber A. These tests were conducted during the period between February 4 to 7, 1969, to verify the MQF emergency oxygen system under altitude conditions simulating loss of cabin pressure during aircraft transit. Installed emergency oxygen system is designed to support six personnel at 35 000 feet altitude for 30 minutes. The test verified the emergency oxygen system under altitude conditions simulating loss of cabin pressure at 35 000 feet.

## 2.0 TEST OBJECTIVES AND RESULTS

Verify the MQF emergency oxygen system is adequate for its intended use.

a. Objective — Determine the altitude at which the emergency oxygen system's alarm is activated and deactivated.

Results — The alarm activated at 11 600, 11 500, and 11 900 feet altitude for the three tests. Deactivation for the same tests was at 8900, 7600, and 7500 feet altitude.

b. Objective — Verify the MQF emergency oxygen will support six people for 10 minutes at 35 000 feet altitude and allow them to descend to a safe altitude of 10 000 feet.

Results — Six personnel oxygen masks were activated at 34 600 feet altitude. Three of the six masks were supporting crewmen; the remaining three were flowing into the MQF environment. Oxygen flow was maintained from the masks for 10 minutes at 34 600 feet and for an additional 21 minutes as the MQF was repressurized to 7500 feet altitude. This was accomplished with the oxygen system supply pressure decreasing from 1975 to 950 psi.

c. Objective — Determine the oxygen flow from one MQF-mounted mask regulator.

Results — One of the mask's oxygen flow was measured and determined to be 3.1 standard liters per minute at 34 600 feet altitude.

### 3.0 TEST SETUP AND CONFIGURATION

The MQF (fig. 1) arrived February 3, 1969, at Ellington AFB and proceeded to MSC building 228 for refuse tank cleaning and auxiliary power unit fuel tank removal. At 1700 hours on February 4, 1969, the MQF was delivered to building 32 and was positioned in chamber A. The facility dolly and loading tracks and the chamber A hoist/crane equipment were utilized (fig. 2). The installation schedule of events is shown in figure 3. The general chamber configuration and test setup are shown in figure 4. Ancillary facility systems provided by SETD for the test operations included the following.

#### 3.1 Personnel Oxygen Supply System

A five K-bottle rack with outlet pressure reduced to 90 psig supplied oxygen into the MQF through a chamber penetration. At the MQF, the supply branched into six outlets connected by flex lines to an oxygen regulator and a mask for each person in the MQF.

#### 3.2 Communications

The facility Nortronics Communications System was extended into the MQF and provided voice communication with the six personnel. All test conversations were taped for review.

#### 3.3 Closed Circuit Television

Facility closed-circuit television cameras were positioned to provide test coverage of personnel inside the MQF. Video tape recordings were made of the test operations.

#### 3.4 Power Supply

A 90-amp 28 V dc power supply was connected to the MQF dc cable inside the chamber.

### 3.5 Test Team

Test team members were assigned from the following contractors and MSC organizations:

- a. Taft Television Company
- b. Brown & Root-Northrop (BRN)
- c. Landing and Recovery Division (LRD)
- d. Space Environment Test Division (SETD)
- e. Medical Operations Office
- f. Reliability and Quality Assurance Office (R&QA)
- g. Flight Safety Office

### 4.0 TEST READINESS AND CERTIFICATION

The Test Readiness Review Board (TRRB) was convened on February 4, 1969, to review and approve all planned test procedures and activities. The test team familiarization dry run of the detailed test procedures was conducted on February 5, 1969. The dry runs included the emergency drills and rescue operations.

### 5.0 TEST OPERATIONS

The pretest briefing of the test team was held at 0730 hours on February 6, 1969. Those members of the test team, required for facility preoperations, reported on station immediately after the test briefing meeting and the initial sequences of the test started at 0807 hours. The remainder of the test team reported on station, in accordance with planned operations (fig. 5). A chronological list of major test events performed is presented. At 1049 hours the test crewmen were ready to ingress the chamber. Prior to chamber pumpdown all six inside personnel went on the facility oxygen system. The T-zero test time was established as the start of chamber pumpdown which occurred at 1116 hours. The three test crewmen remained on the facility oxygen system until a chamber altitude of 35 000 feet altitude was reached at 1254 hours and then transferred to the MQF oxygen system. The other three occupants (inside observers) remained on the facility oxygen system. The test activities of activating and deactivating the MQF emergency oxygen system and of having three



crewmembers live from this system for at least 10 minutes were completed as planned (figs. 5 and 6).

While holding the chamber pressure at 35 000 feet (180 torr) for 10 minutes, the emergency oxygen system flow was recorded at 1-minute intervals. Chamber was then repressurized to ambient conditions and the chamber pressure recorded (fig. 6). As the chamber pressure passed through 10 000 feet altitude (523 torr) the crewmembers changed from the MQF emergency oxygen system to the facility oxygen system.

There were no holds throughout the test operations and the total test time was 5 hours and 24 minutes. The manned operations phase of the test was the last 2 hours and 41 minutes. The three crewmembers had remained on the MQF emergency oxygen system for approximately 31 minutes and the pressure in the oxygen supply tank decreased from 1975 to 950 psi.

One incident occurred during chamber pumpdown to 35 000 feet (180 torr). Crewmember number 3 reported that a glue smell was becoming noticeable in the facility oxygen supply system. The odor disappeared when another K-bottle was transferred to the oxygen system. An investigation and analysis will be made of the suspect K-bottle.

## 6.0 SUMMARY AND CONCLUSION

The MQF altitude test was performed per the Detailed Test Procedures of January 31, 1969. The test was completed on schedule and all test objectives were fulfilled. The MQF oxygen system performed within the procurement specifications. All altitude test requirements were satisfied and no additional altitude testing has been identified.

## 7.0 REFERENCES

### 7.1 Test Documentation

Additional Mobile Quarantine Facility altitude test documents are available for references:

Test Plan for MQF Chamber A Altitude Test dated January 28, 1969

Test Rules Project Apollo Chamber A MQF dated January 28, 1969

Detail Test Procedures Project Apollo MQF Altitude Test dated January 31, 1969

SESL Technical Report of MQF Altitude Test dated February 10, 1969

## 7.2 Photographs

The following color photographs were taken of the MQF:

S-69-18746	Arrival at building 32
S-69-18748	Positioning for hoist
S-69-18747	Sling installation
S-69-18749	Moving into chamber on dolly
S-69-18753	Chamber hoist and sling installation
S-69-18750	Chamber lift
S-69-18752	Chamber positioning
S-69-18751	Installed in chamber A
S-69-18754	Installed in chamber A
S-69-18733	Rear entrance with TV installation
S-69-18743	Rear entrance
S-69-18744	View from 31-foot level
S-69-18734	Interior view
S-69-18736	Crewmen preparation
S-69-18738	Crewmen preparation
S-69-18739	Crewmen preparation
S-69-18740	Crewmen test configuration

## 7.3 Motion Pictures

A 16-mm color documentary film "Mobility Quarantine Facility Altitude Test in Chamber A SESL February 6, 1969," S-69-30 is available.

Chronological List of Major Events

February 6, 1969

- 0805 Duty stations manned for start of pre-ops on electrical utilities, fire suppression, and repressurization systems.
- 0909 Emergency generators numbers 1 and 2 on line.
- 0937 Vacuum pre-ops started.
- 0947 Pre-ops on utilities and repressurization system complete.
- 1025 Pre-ops on vacuum system completed.
- 1026 Chamber inspection completed.
- 1030 Pre-ops on electrical and fire suppression system completed.
- 1035 All facility systems pre-ops completed and facility in go condition.
- 1049 Pretest checklist completed.
- 1050 Crew ingressing into MQF.
- 1055 Crew ingressing completed.
- 1107 Chamber doors configured and sealed. Seal document submitted.
- 1116 Initiated roughing on chamber in auto mode.
- 1125 Chamber pressure at 560 torr. Changed over roughing system from auto to manual mode.
- 1127 Initiated roughing on chamber in manual mode.
- 1144 Closed COV-102 and secured roughing system. Pch 488 torr MQF O<sub>2</sub> system activated.
- 1145 Chamber repress initiated with equal values MA1 and MA2.
- 1150 Repress stopped at 550 torr. MQF O<sub>2</sub> system deactivated.
- 1157 COV-102 opened and roughing on chamber in manual mode started.
- 1209 Closed COV-102 and secured roughing system. Pch 497 torr MQF O<sub>2</sub> system activated.

1210 Chamber repress initiated through MA1 and MA2.  
1216 Repress stopped at 571 torr. MQF O<sub>2</sub> system deactivated.  
1217 Manlocks 1 and 2 inner doors unlatched.  
1223 COV-102 opened and roughing on chamber in auto mode.  
1227 MQF emergency O<sub>2</sub> system activated at 490 torr.  
1235 IO1 reported odor of glue.  
1252 COV-102 closed and roughing system secured. Pch 180 torr,  
35 000-ft altitude.  
1254 MQF O<sub>2</sub> masks activated.  
1302 Chamber pressure at 183 torr.  
1304 10 minutes at 35 000-foot altitude complete — descent au-  
thorized.  
1305 Commenced chamber repress to ambient through ML A1 and A2  
equal. valves.  
1330 Initiated repress in PFG mode and actuated COV-1573 (air  
inlet valve).  
1331 Chamber at ambient ML inner doors A1 and A2 open.  
1332 Initiated vs mode.  
1334 Crew egressing completed.  
1336 All systems started securing. Duty stations secured.

## MOBILE QUARANTINE FACILITY

DATE:	ALTITUDE TEST	TEST NO.
2/6/69		21-A-69

O<sub>2</sub> SYSTEM ACTUATIONFirst run

Activation pressure: 490 torr

Deactivation pressure: 545 to 550 torr

Second run

Activation pressure: 495.5 torr

Deactivation pressure: 572 torr

Third run

Activation pressure: 488 torr

Deactivation pressure: 575 torr

## MOBILE QUARANTINE FACILITY

DATE:  
2/6/69

ALTITUDE TEST

TEST NO.  
21-A-69

## DATA SHEET

35 000-FOOT ALTITUDEOXYGEN FLOW RATE

<u>Time, min</u>	<u>Oxygen flow rate, sccm</u>
1	3125
2	3125
3	3100
4	3100
5	3100
6	3100
7	3100
8	3100
9	3100
10	3100

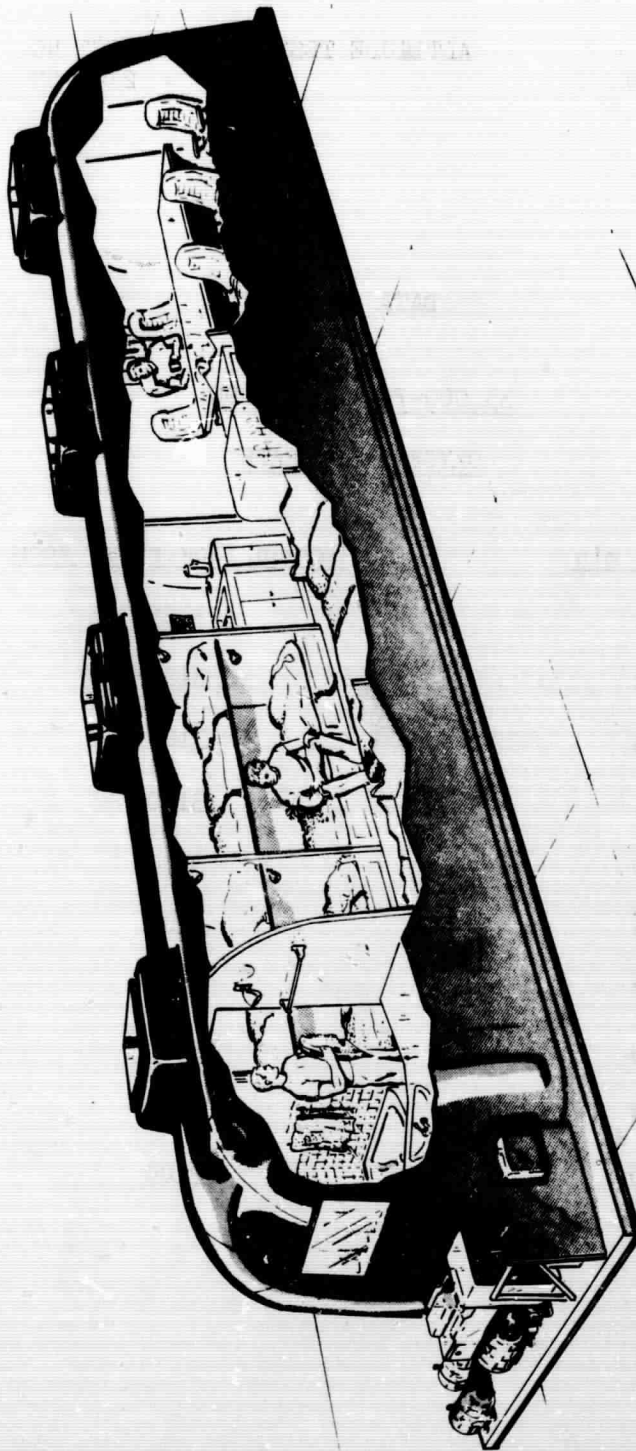


Figure 1.- Mobile quarantine facility-cutsaway view.

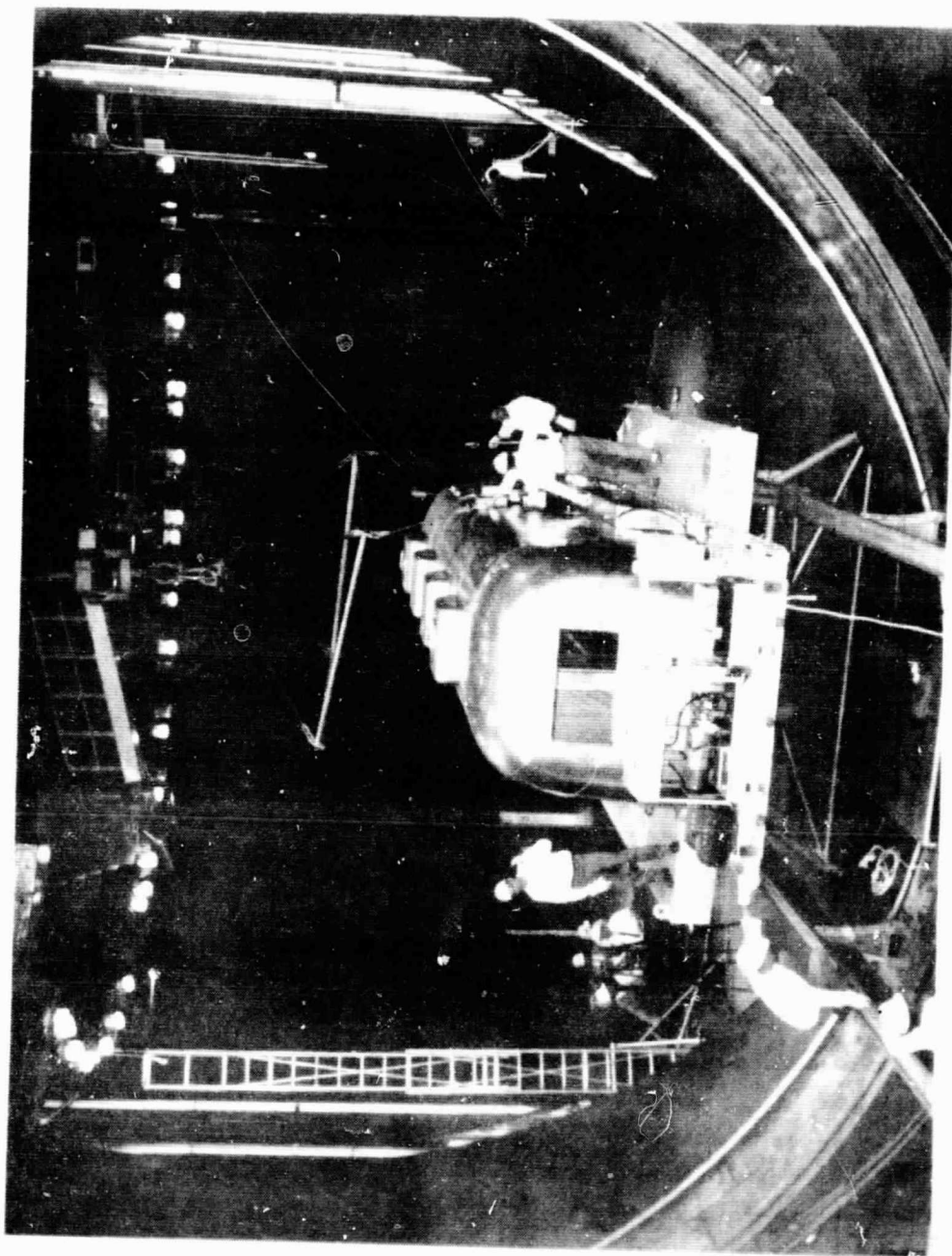


Figure 2.- The MQF chamber hoist and sling installation (photograph no. S-69-18753).



RELEASE DATE: 1-23-69 REVISED: _____ STATUS AS OF: _____		MOBILE QUARANTINE FACILITY (MQF) TEST SESL - CHAMBER A														APPROVED BY: <i>W. J. [Signature]</i> TEST MANAGER			
1969 20 21 22 23 24 25 26 27 28 29 30 31		JANUARY 1 2 3 4 5 6 7 8 9 10 11 12														FEBRUARY 1 2 3 4 5 6 7 8 9 10 11 12			
		TEST PLAN <input type="checkbox"/>														DT? <input type="checkbox"/>		TRRB <input type="checkbox"/>	
FACILITY UPDATE		MSC <input type="checkbox"/>														MQF ON DOCK <input type="checkbox"/>		INSTALL TRACK & DOLLY <input type="checkbox"/>	
		INSTALL VAN <input type="checkbox"/>														CHECKOUT <input type="checkbox"/>		MANNED TEST <input type="checkbox"/>	
		REMOVE <input type="checkbox"/>																	

Figure 3.- Schedule of MQF operations in chamber A.

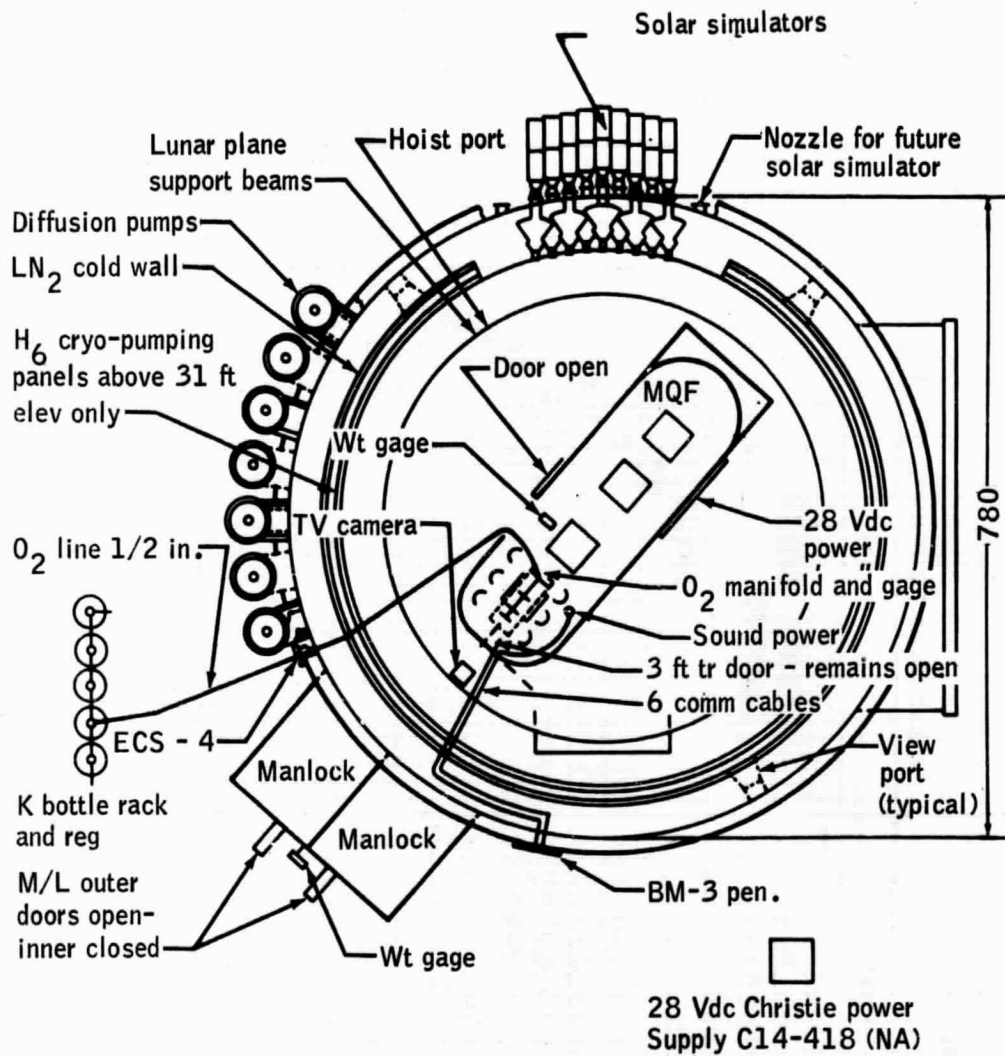


Figure 4.- The MQF/chamber A general arrangement.

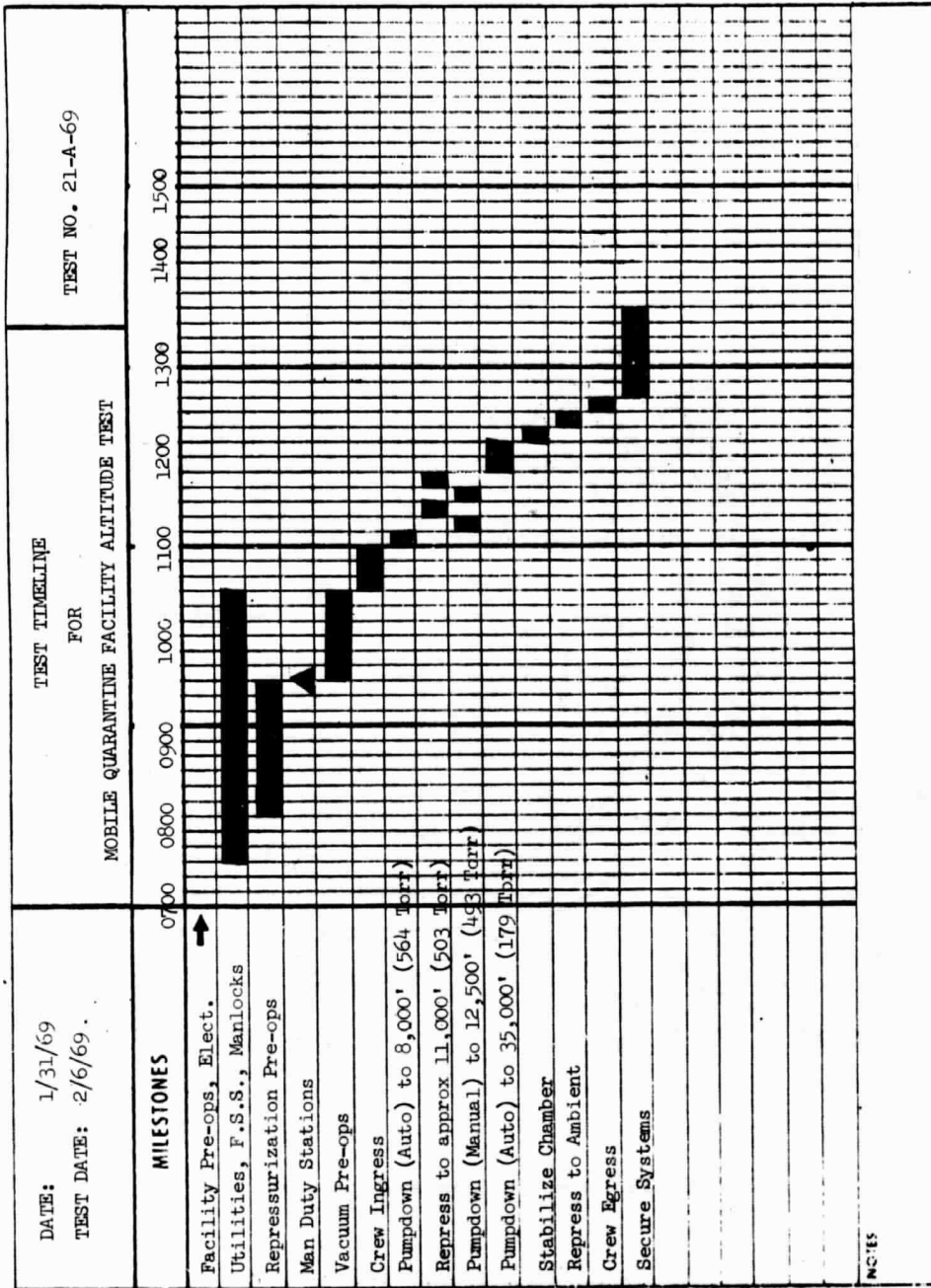


Figure 5.- Test time line for mobile quarantine facility altitude test.

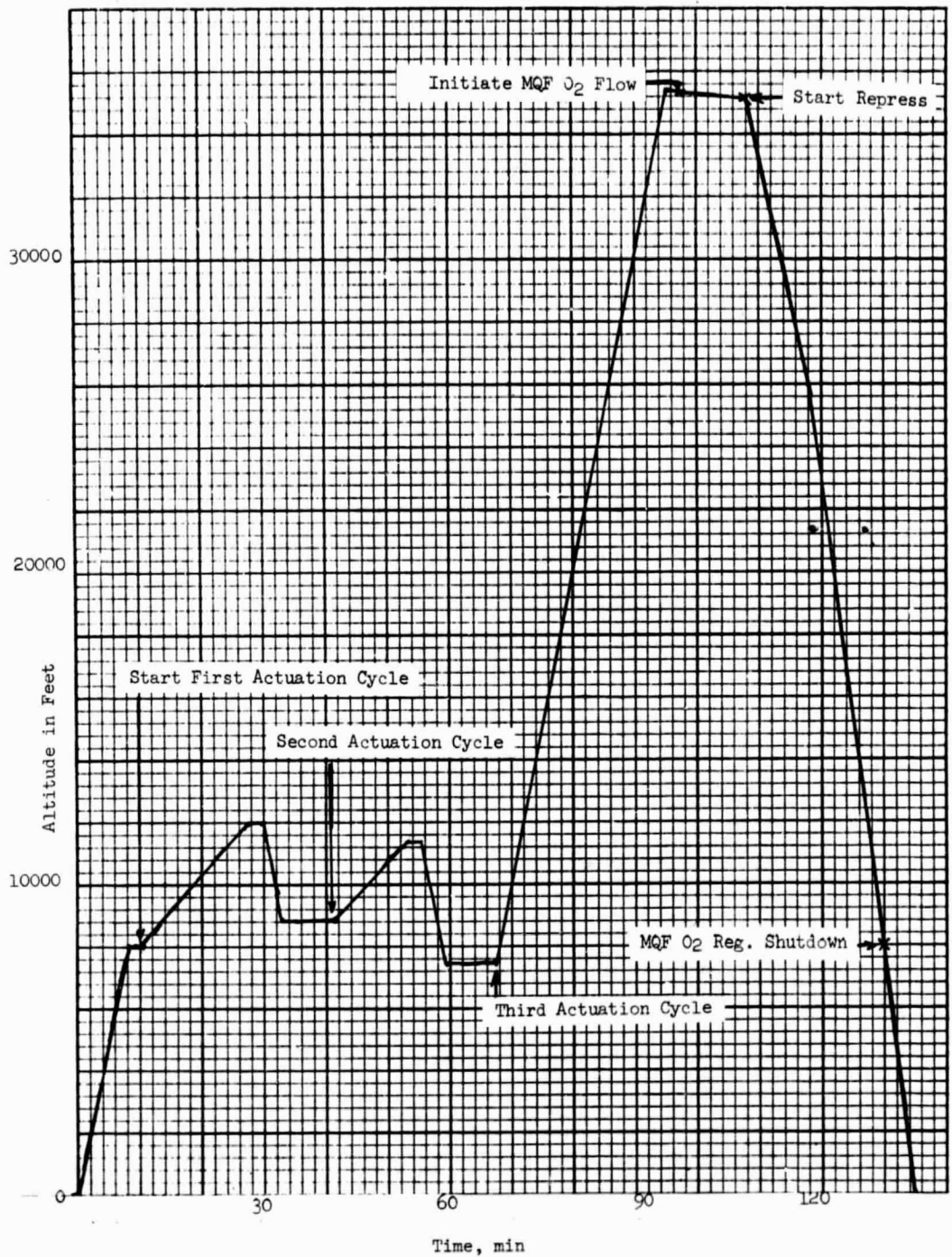


Figure 6.- High altitude vs time.